18. (Amended) A spirally wound paperboard core comprising a plurality of structural plies made from moist paper, at least one said structural ply having a machine direction modulus of elasticity of at least 7500 MPa, and a cross machine direction modulus of elasticity greater than 4500 MPa, and wherein said at least one structural ply being formed by press-drying under simultaneous application of heat and perpendicular pressure to the moist paper thereby to cause said at least one structural ply to exhibit a squareness of less than 2.40, wherein the squareness is a ratio between the machine direction modulus of elasticity and the cross machine direction modulus of elasticity.

REMARKS

Favorable reconsideration and allowance of this application are requested.

At the outset, claims 24-27 have been cancelled without prejudice or disclaimer thereby leaving claims 18-23 pending herein for consideration. Independent claim 18 (the sole independent claim which remains pending herein) for consideration has been amended so as to emphasize and clarify various aspects of the subject invention and to more clearly distinguish the same over the applied art of record.

More specifically claim 18 has been amended so as to clarify that at least one ply of the spirally wound paperboard core is formed by press-drying under the simultaneous application of heat and perpendicular pressure – that is, so as to more clearly set fort that the ply is made by the so-called Condebelt press drying process. Support for such language may be found, for example, in the originally filed specification at page 8, line 26 bridging page 9, line 11.

Claim 18 has further been revised so as to clarify the "squareness" of the ply and to define an upper limit for such squareness. In this regard, the specification at page 5, lines 13-30, the term "squareness" is set forth. The "squareness" is a ratio of the machine direction modulus of elasticity to the cross machine direction modulus of elasticity, with the theoretical lower limit being 1.0 (i.e., where the machine and cross

machine moduli of elasticity are equal). Furthermore, on page 9, line 14 through page 10, line 1 of the specification, it is disclosed that, by press-drying, the machine direction elasticity modulus of the structural plies of lower strength class can be raised to a level of at least about 7,500 – 10,000 MPa, and that the elasticity modulus in the cross machine direction can be raised to a level of about 4,500 – 5,000 MPa. When structural plies according to the invention are used that are manufactured from the better quality press-drying material, this specification passage notes that the machine direction elasticity modulus can be raised to a level of about 10,000 – 12,000 MPa and that the cross machine direction elasticity modulus can be raised to a level of about 5,000 – 8,000 MPa. Hence, from such specification passages, the "squareness" is less than 12,000/5,000 = 2.40.

The only issue remaining to be resolved in this application is the Examiner's rejection of prior claims 18-27 as allegedly being anticipated under 35 USC §102(b) from Qui et al (USP 5,505,395). Applicants suggest that Qui et al is inappropriate as a reference against the claims as now pending herein.

The problem solved according to the present invention is how to achieve a core that has better stiffness -- i.e. better beam strength to meet with the new demands of e.g. the printing presses. In other words, the applicants' goal was to achieve a core whose critical revolution is higher than in known cores. In the widest printing presses, which require a wider/ faster web, the inside diameter of the core has been changed to 150 mm in order to solve the vibration problem. So far, this arrangement has functioned well. Now, the same problem as with earlier machines, until transferring to 150 mm cores, will be faced again with the running parameters of the new machines being designed. In other words, the risky range of natural vibration of the rest reel will again be revisited.

For this reason, the stiffness of the core has to be increased in one way or another, while avoiding an increase in the inside diameter of the core. The solution the present applications have offered to these problems is to construct a multiply core having at least

one ply that has been manufactured of coreboard made by a specific press drying method know as the Condebelt-method.[2]

Thus according to the present invention, the high value of the modulus of elasticity of the Condebelt board in the cross machine direction is an important factor in the present invention ***combined with*** the high modulus of elasticity in the machine direction. As the art of record evidences, however, board having a high modulus of elasticity in the machine direction can be manufactured. But in such cases, the modulus of elasticity in the cross machine direction remains substantially low. In other words, those skilled in the art recognise the "fact" that, if a modulus of elasticity is made relatively high in one of the machine or cross machine directions it will be low in the other direction.

Turning attention to the applied Qui et al reference, applicants note that Qui et al cannot possibly anticipate the present invention. Specifically, Qui et al discloses a cross machine direction modulus of elasticity of 0.53 M psi which corresponds *only* to 3660 MPa. The present invention, of course, specifically requires that the cross machine direction modulus of elasticity be ***greater than*** 4500 MPa. Hence, contrary to the assertions by the Examiner, the structural ply of Qui et al does ***not*** inherently possess a cross machine direction modulus of elasticity as defined in the present applicants' claims.

Nor can Qui et al be considered to render obvious the present invention. IN this regard, Qui et al merely discloses a multi-grade spirally wound paperboard winding core. The winding core of Qui et al has a central paperboard layer formed from lower density paperboard, and outwardly located structural paperboard layers formed from higher density paperboard. One main object of the Qui et al disclosure is to minimize the reduction of the inner diameter of paperboard winding cores ("ID comedown") under radial compression forces during a winding process. For this purpose, Qui et al provides multi-grade paperboard winding cores having a plurality of structural

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[2] In order to assist the Examiner in his understanding of the Condebelt method, several articles are attached for his technical review and are listed on an appropriate form PTO-1449 for the Examiner's convenience.

paperboard plies of different densities and strength. IN order to achieve an increased *radial* stiffness of the cores, structural plies having a high modulus of elasticity in the machine direction are provided.

Table 1 of Qui et al shows that the stiffness (modulus of elasticity) of the structural plies in the cross machine direction is by a factor of approx. 3.0 *smaller than* in the machine direction. For the relatively large winding angles a of the cores ($\alpha > 55°$ according to Qui et al (col. 8, lines 6-8), the stiffness of the structural plies in the cross machine direction has only a relatively small influence on the ID comedown. However, the stiffness of the structural plies in the cross machine direction determines the axial stiffness as well as the bending stiffness of the core under static and dynamic load. Meanwhile, for the relatively large winding angles $\alpha > 55°$, the high stiffness of the structural plies in the machine direction of Qui et al hardly improves neither the axial stiffness nor the bending stiffness of the core under static and dynamic load.

As a result, the highly anisotropic properties of the structural plies according to Qui et al lead to a ***low axial stiffness and bending stiffness of the core*** as compared to its resistance to ID comedown. Therefore, paperboard cores according to Qui et al are not appropriate for applications where high axial and bending stiffness are required, e. g. by the running parameters of new printing presses.

In direct contrast to Qui et al as discussed above, the present invention provides a spirally wound paperboard core with a structural ply having a high axial stiffness and bending stiffness of the core, under static and dynamic load, without a need to change the core structure in any other way ***except*** for the raw material. In this regard, the "raw" material for the core are the plies that are wound into the core. As discussed immediately above, technical problem underlying the present invention is not addressed at all by Qui et al.

According to the present invention, the problem mentioned above is solved by, among other things, the definition of a target range for the squareness (< 2.4) of the structural ply along with a minimum modulus of elasticity in the cross machine direction

of the structural ply ($E_{CD} \geq 4500$ MPa). Furthermore, in order to achieve these material properties, the structural ply is defined to be press-dried under simultaneous application of heat and perpendicular pressure to the moist paper.

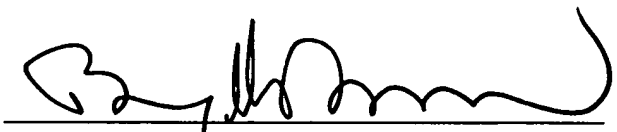
Due to these technical features, the underlying technical problem is solved. In particular, the relatively low squareness, i.e. the relatively high isotropy of the structural ply leads to a high axial stiffness and bending stiffness of the core under static and dynamic load without a need to change the core structure in any other way except for the raw material.

An ordinarily skilled person would clearly not be directed to such technical features by the disclosure in Qui et al. Indeed, as noted previously, such an ordinarily skilled person would have been led directly away from the technical features of the present invention.

In view of the amendments and remarks above, applicants suggest that the present invention as defined in the pending claims is in condition for allowance and Official Notice to that effect is solicited.

Respectfully submitted,

NIXON & VANDERHYE P.C.

By: 

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APPENDIX I

Marked-Up Version of Amended Claims Pursuant to 37 CFR §1.121(c)

18. (Amended) A spirally wound paperboard core [,] comprising [:said paperboard core comprising] a plurality of structural plies made from moist paper, at least one [of] said structural ply [made by press drying in a machine having machine and cross machine directions, and] having a machine direction modulus of elasticity of at least 7500 MPa, and a cross machine direction modulus of elasticity greater than 4500 MPa, and wherein said at least one structural ply being formed by press-drying under simultaneous application of heat and perpendicular pressure to the moist paper thereby to cause said at least one structural ply to exhibit a squareness of less than 2.40, wherein the squareness is a ratio between the machine direction modulus of elasticity and the cross machine direction modulus of elasticity.